Appendix 5 – Acid Sulfate Soil Assessment and Preliminary Waste Classification Assessment prepared by Environmental Investigation Services

ENVIRONMENTAL INVESTIGATION SERVICES

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ACID SULFATE SOIL ASSESSMENT AND PRELIMINARY WASTE CLASSIFICATION ASSESSMENT
PROPOSED RESIDENTIAL DEVELOPMENT
177 RUSSELL AVENUE, DOLLS POINT

1 INTRODUCTION

Helm ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake an acid sulfate soil assessment and preliminary waste classification assessment for the proposed residential development at 177 Russell Avenue, Dolls Point. The site location is shown on Figure 1 and the investigation was confined to the proposed development area as shown on Figure 2. This report describes the investigation procedures and presents the results of the assessment together with comments, discussion and recommendations.

A geotechnical investigation was undertaken in conjunction with this assessment by JK Geotechnics[2] and the results are presented in a separate report (Ref. 29353Srpt, dated 25/5/16).

1.1 Proposed Development Details

The proposed development includes demolition of the existing structures on-site and construction of a multi-storey residential building. Excavation to a depth of approximately 6m is expected to be required for construction of a 2-level basement.

1.2 Objectives

The assessment objectives were to:

- Assess the potential for acid sulfate soils at the site; and
- Provide a preliminary waste classification for the off-site disposal of surplus soil.

[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)
[2] Geotechnical consulting division of J&K

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1.3 Scope of Work

The investigation was undertaken generally in accordance with an EIS proposal (Ref: EP9852KM) of 5/4/16 and written acceptance from Helm of 18/4/16.

The scope of work included the following:

- A review of relevant geological information and acid sulfate soil (ASS) risk maps;
- Walkover inspection of the site;
- Soil sampling from five boreholes drilled for the JK geotechnical investigation;
- Analysis of selected soil samples for acid sulfate soil characteristics using the sPOCAS method; and
- Analysis of selected soil samples for contaminants of potential concern to provide a preliminary waste classification.

The report was prepared with reference to regulations/guidelines outlined in the table below. Individual guidelines are also referenced within the text of the report.

Table 1-1: Guidelines

Guidelines/Regulations
Contaminated Land Management Act 1997[3]
State Environmental Planning Policy No.55 – Remediation of Land 1998[4]
Guidelines for Consultants Reporting on Contaminated Sites 2011[5]
Guidelines for the NSW Site Auditor Scheme, 2nd Edition 2006[6]
National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended 2013[7]

2 INFORMATION ON ACID SULFATE SOILS

2.1 Background

Acid sulfate soils (ASS) are formed from iron-rich alluvial sediments and sulfate (found in seawater) in the presence of sulfate-reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes.

[3] NSW Government Legislation, (1997), *Contaminated Land Management Act 1997.* (referred to as CLM Act 1997)
[4] NSW Government, (1998), *State Environmental Planning Policy No. 55 – Remediation of Land.* (referred to as SEPP55)
[5] NSW Office of Environment and Heritage (OEH), (2011), *Guidelines for Consultants Reporting on Contaminated Sites.* (referred to as Reporting Guidelines 2011)
[6] NSW DEC, (2006), *Guidelines for the NSW Site Auditor Scheme, 2nd ed.* (referred to as Site Auditor Guidelines 2006)
[7] National Environment Protection Council (NEPC), (2013), *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

These soils include those that are producing acid (termed actual ASS) and those that can become acid producing (termed potential ASS or 'PASS'). PASS are naturally occurring soil and sediment that contain iron sulfides (pyrite) which, when exposed to oxygen generate sulfuric acid.

2.2 The ASS Management Advisory Committee (ASSMAC)

The NSW government in 1994 formed the ASSMAC to coordinate a response to ASS issues. In 1998 this group released the Acid Sulfate Soil Manual[8] providing best practice advice for planning, assessment, management, laboratory methods, drainage, groundwater and the preparation of ASS management plans (ASSMP).

In 1997 the Department of Land and Soil Conservation (now part of the Office of Environment and Heritage[9]) developed two series of maps with respect to ASS for use by council and technical staff implementing the ASS Manual 1998:

- ASS Planning Maps – issued to councils and government units; and
- ASS Risk Maps – issued to interested parties.

2.3 The ASS Planning Maps

The ASS planning maps provide an indication of the relative potential for disturbance of ASS to occur at locations within the council area. These maps do not provide an indication of the actual occurrence of ASS at a site or the likely severity of the conditions. The maps are divided into five classes depending on the type of activities or works that if undertaken, may represent an environmental risk through the development of acidic conditions associated with ASS:

Table 2-1: Risk Classes

Risk Class	Description
Class 1	All works.
Class 2	All works below existing ground level and works by which the water table is likely to be lowered.
Class 3	Works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.
Class 4	Works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level.
Class 5	Works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent land.

[8] *Acid Sulfate Soils Manual,* Acid Sulfate Soils Management Advisory Committee (ASSMAC), 1998 (ASS Manual)

[9] http://www.environment.nsw.gov.au/acidsulfatesoil/index.htm

2.4 The ASS Risk Maps

The ASS risk maps provide an indication of the probability of occurrence of PASS at a particular location based on interpretation from geological and soil landscape maps. The maps provide classes based on high probability, low probability, no known occurrence and areas of disturbed terrain (site specific assessment necessary) and the likely depth at which ASS are likely to be encountered.

2.5 Investigation and Laboratory Testing for ASS

The ASS Manual includes information on assessment of the likelihood of PASS, the need for an ASS Management Plan and the development of mitigation measures for a proposed development located in PASS risk areas. The ASS Manual recommends a minimum of four sampling locations for a site with an area up to 1ha. For sites greater than 4ha, the manual recommends the use of a reduced density of 2 locations per hectare subject to the proposed development. For lineal investigations, the manual recommends sampling every 50-100m.

The sampling locations should include all areas where significant disturbance of soils will occur and/or areas with a high environmental sensitivity. In some instances a varied sampling plan may be more suitable, particularly for sites less than 1,000m^2 in area. The depth of investigation should extend to at least 1m beyond the depth of proposed excavation/disturbance or estimated drop in water table height, or to a minimum of 2m below existing ground level, whichever is greatest.

Standard methods for the laboratory analysis of samples are presented in the Australian Standard AS4969-2008/09[10] (parts 1 to 14). The principal analytical method is suspension Peroxide Oxidation Combined Acidity and Sulfur (sPOCAS). The sPOCAS method specified in AS4969-2008/09 supersedes the POCAS method specified in the ASS Manual 1998. When S_{POS} (peroxide oxidisable sulfur) values are close to the action criteria confirmation of the result can be undertaken by the chromium reducible sulfur (S_{CR}) method.

The endpoint for the pH titration in AS4969-2008/09 is pH6.5 as opposed to pH5.5 adopted in the ASS Manual. Therefore the values for Total Actual Acidity (TAA), Total Sulfide Acidity (TSA) and Total Potential Acidity (TPA) will be more conservative when analysed using the sPOCAS method specified in AS4969-2008/09.

3 SITE INFORMATION

3.1 Site Description

The site is located within relatively flat, low-lying coastal topography near Botany Bay which is located approximately 300m to the south and east. The relatively flat site is bound by Russell Avenue to the north and consists of a rectangular block extending over four lots: Lots 80-83 in DP2237.

[10] *Analysis of acid sulfate soil – Dried samples – Methods of test, Parts 1 to 14,* Standards Australia, 2008/2009 (AS4969-2008/09)

The general layout of the site at the time of this assessment is shown in the attached Figure 1. At the time of the assessment the site contained two-storey brick unit blocks, a carport, concrete footpaths, a driveway extending from Russell Avenue and grassed lawn areas and garden beds. Trees and shrubs were located on-site as shown in Figures 1 and 2.

A four-storey brick apartment building was located on the adjacent site to the west. Directly to the east of the site was a sandstone block-lined water channel, Waradiel Creek, which was offset at a distance of approximately 0.5m to 5m from the eastern site boundary. The channel was lined with mangrove trees. Located directly to the south of the site was Peter Depena Reserve – a grassed public park interspersed with large trees.

3.2 Regional Geology

The geological map of Sydney (1983[11]) indicates the site to be underlain by Holocene deposits of quartz sand with minor shell content, interdune silt and fine sand.

3.3 Rockdale City Council Local Environmental Plan (LEP)

A review of the Rockdale City Council LEP indicates that the site is located in a Class 3 acid sulfate soil risk area.

3.4 Acid Sulfate Soil (ASS) Risk Map

A review of the ASS risk maps prepared by the Department of Land and Water Conservation (1997[12]) indicates that the site is located in an area considered to have a low probability of occurrence of acid sulfate soils at depths of 1m-3m below ground level.

4 ASSESSMENT CRITERIA

4.1 Acid Sulfate Soil Assessment Criteria

The ASS Manual presents "action criteria" for the interpretation of laboratory results. The action criteria define the need to prepare a management plan and are based on the percentage of oxidisable sulfur (or equivalent Total Potential Acidity [TPA]) for broad categories of soil types. Where disturbance of greater than 1,000 tonnes of ASS is proposed, the action criteria for 'coarse textured soils' apply to all soil types.

[11] *1:100,000 Geological Map of Sydney (Series 9130)* Department of Mineral Resources (1983)

[12] Department of Land and Water Conservation, (1997), *1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2).*

The following action criteria are presented in the ASS Manual:

Table 4-1: ASS Action Criteria

Category	Description	Criteria
Coarse Textured Soils	Sands to loamy sands	• pH - less than 5; • Total Actual Acidity (TAA)/Total Sulfide Acidity (TSA)/ Total Potential Acidity (TPA) (pH5.5) – greater than 18mol H^+/tonne; and • S_{pos} – greater than 0.03% sulfur oxidisable.
Medium Textured Soils	Sandy loams to light clays	• pH - less than 5; • TAA/TSA/TPA (pH5.5) – greater than 36mol H^+/tonne; and • S_{pos} – greater than 0.06% sulfur oxidisable.
Fine Textured Soils	Medium to heavy clays and silty clays	• pH - less than 5; • TAA/TSA/TPA (pH5.5) – greater than 62mol H^+/tonne; and • S_{pos} – greater than 0.1% sulfur oxidisable.

The action criteria for coarse textured soils have been adopted for this assessment. This is based on the predominant soil type encountered at the sampling locations (i.e. sand or silty sand).

4.2 Preliminary Waste Classification Assessment Criteria

Off-site disposal of fill, contaminated material, stockpiled soil, natural soil and rock excavated as part of the proposed development works is regulated by the Protection of the Environment Operations Act (1997[13]) and associated regulations and guidelines including the NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014[14]).

Soils are classed into the following categories based on the chemical contaminant criteria outlined in the guidelines:

Table 4-2: Waste Categories

Category	Description
General Solid Waste (non-putrescible) (GSW)	• If Specific Contaminant Concentration (SCC) ≤ Contaminant Threshold (CT1) then Toxicity Characteristics Leaching Procedure (TCLP) not needed to classify the soil as GSW; and • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as GSW.
Restricted Solid Waste (non-putrescible) (RSW)	• If SCC ≤ CT2 then TCLP not needed to classify the soil as RSW • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as RSW

[13] NSW Government, (1997), *Protection of Environment Operations Act.* (POEO Act 1997)

[14] NSW EPA, (2014), *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

Category	Description
Hazardous Waste (HW)	• If SCC > CT2 then TCLP not needed to classify the soil as HW • If TCLP > TCLP2 and/or SCC > SCC2 then treat as HW
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following criteria: • Has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • Does not contain sulfidic ores or other waste; and • Includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette.

5 INVESTIGATION PROCEDURE

5.1 Subsurface Investigation and Soil Sampling Methods

Field work for this investigation was undertaken from the 2nd to the 6th of May 2016. Soil samples were obtained from four boreholes drilled for the JK geotechnical investigation. The sampling locations are shown on the attached Figure 2. The sample locations were drilled using a truck-mounted hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.

Soil samples were obtained at various depths, based on observations made during the field investigation. All samples for the acid sulfate soil assessment were placed in plastic bags and sealed with plastic ties with minimal headspace, while samples for the waste classification assessment were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. Each sample was labelled with a unique job number, the sampling location, sampling depth and date. All samples were recorded on the borehole logs attached in the appendices.

The samples were preserved by immediate storage in an insulated sample container with ice. On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

5.2 Laboratory Analysis

For the preliminary waste classification, four fill and one natural soil sample obtained from the site were analysed for potential contaminants of concern (PCC) using the analytical methods detailed in Schedule B(3) of NEPM 2013. The PCC included heavy metals, total recoverable hydrocarbons (TRH), BTEX (benzene, toluene, ethylbenzene and xylenes), polycyclic aromatic hydrocarbons (PAHs),